

09/603,935

KICHP0102USA

Listing of Claims

1. (Currently Amended) A pressure transducer comprising:
a sensing tube allowing flow therethrough, at least a portion of which mechanically deforms in response to a pressure on one side thereof; and
at least one strain gage on the sensing tube for measuring deformation of the at least a portion of the sensing tube; and
a housing at least partially surrounding the sensing tube.
2. (Original) The pressure transducer of claim 1, wherein the sensing tube has a perimeter, and the at least a portion of the sensing tube extends fully around the perimeter.
3. (Withdrawn) The pressure transducer of claim 1, wherein the tube has a perimeter, and the at least a portion of the sensing tube does not extend fully around the perimeter.
4. (Original) The pressure transducer of claim 1, wherein the sensing tube has a circular cross section.
5. (Original) The pressure transducer of claim 4, further comprising a pipe flange for connecting a pipe to the sensing tube, wherein an inner diameter of the pipe flange and an inner diameter of the sensing tube are substantially identical.
6. (Original) The pressure transducer of claim 5, wherein the pipe flange has threads thereupon to mate with threads on a pipe segment which has an inner diameter which is substantially identical to the inner diameter of the pipe flange.

09/603,935

KICHP0102USA

7. (Withdrawn) The pressure transducer of claim 1, wherein the sensing tube has a rectangular cross section.

8. (Withdrawn) The pressure transducer of claim 1, wherein the sensing tube has a square cross section.

9. (Withdrawn) The pressure transducer of claim 1, further comprising a flow restriction in the sensing tube, the least one strain gage including one or more strain gages one each side of the flow restriction for determining the pressure drop across the flow restriction.

10. (Withdrawn) The pressure transducer of claim 9, wherein the flow restriction includes an orifice.

11. (Currently Amended) The pressure transducer of claim 1, wherein the at least one strain gage is on a second ~~another~~ side of the at least a portion of the sensing tube;

wherein the second side and the one surface are on opposite major surfaces of the at least a portion which is opposite the one side.

12. (Currently Amended) The pressure transducer of claim 1, wherein the ~~further comprising a housing~~ encircles ~~encircling~~ the sensing tube.

13. (Withdrawn) The pressure transducer of claim 12, wherein the housing includes a cover and a pair of pipe connectors for coupling the housing-to-pipe segments.

14. (Withdrawn) The pressure transducer of claim 13, wherein the cover is cylindrical.

09/603,935KICHP0102USA

15. (Withdrawn) The pressure transducer of claim 13, wherein the housing further includes a cylinder between the sensing tube and the cover.

16. (Withdrawn) The pressure transducer of claim 13, wherein the cover includes one or more access doors.

17. (Withdrawn) The pressure transducer of claim 16, wherein at least one of the access doors has an electrical connector therein.

18. (Withdrawn) The pressure transducer of claim 13, wherein the cover has open ends, each of the open ends having a housing flange attached thereto.

19. (Original) The pressure transducer of claim 12, wherein the sensing tube is attached to the housing.

20. (Original) The pressure transducer of claim 19, wherein the sensing tube includes an end portion which is attached to the housing and a central portion to which the at least one strain gage is mounted.

21. (Original) The pressure transducer of claim 20, wherein the end portion has a thicker wall than the central portion.

22. (Original) The pressure transducer of claim 21, wherein the sensing tube further includes a curved portion linking the end portion and the central portion.

23. (Original) The pressure transducer of claim 22, wherein the curved portion has a constant radius of curvature.

09/603,935

KICHP0102USA

24. (Withdrawn) The pressure transducer of claim 22, wherein the curved portion is tapered, having a radius of curvature which increases closer to the thinner portion.

25. (Original) The pressure transducer of claim 22, wherein at least one of the at least one strain gage is located adjacent to the curved portion.

26. (Withdrawn) The pressure transducer of claim 21, wherein the end portion includes a connecting member which is attached to the housing and a rib which is mechanically isolated from the housing.

27. (Withdrawn) The pressure transducer of claim 26, wherein the connecting member is mechanically isolated from the rib by a groove between the connecting member and the rib.

28. (Withdrawn) The pressure transducer of claim 27, wherein one end of the sensing tube is attached to the housing and another end of the sensing tube is slidably mounted in the housing.

29. (Withdrawn) The pressure transducer of claim 28, wherein the one end is welded or mechanically attached to the housing and the another end is mounted to the housing with a flexible seal therebetween.

30. (Currently Amended) The pressure transducer of claim 21, wherein the sensing tube includes a second end portion, ~~portions~~; the end portions having different outside diameters.

31. (Original) The pressure transducer of claim 1, wherein the transducer includes at least two strain gages, one of the at least two gages used for measuring

09/603,935

KICHP0102USA

axial strain and another of the at least two gages used for measuring circumferential strain.

32. (Original) The pressure transducer of claim 1, wherein the transducer includes at least four strain gages, at least two of the gages used for measuring axial strain and another at least two of the gages used for measuring circumferential strain.

33. (Original) The pressure transducer of claim 32, wherein the at least two of the gages used for measuring axial strain and the another at least two of the gages used for measuring circumferential strain are connected together in a Wheatstone bridge.

34. (Original) The pressure transducer of claim 1, wherein the sensing tube is made of metal.

35. (Original) The pressure transducer of claim 1, wherein the at least a portion of the sensing tube includes a thinner portion which amplifies the changes in shape.

36. (Currently Amended) A pressure transducer comprising:
a sensing tube allowing flow therethrough, at least a portion of which changes shape in response to a pressure on one side thereof; ~~and~~
a sensor for measuring the changes in shape of the at least a portion of the sensing tube; and
a housing at least partially surrounding the sensing tube.

37. (Original) The pressure transducer of claim 36, wherein the sensor includes a means for measuring the changes in shape of the at least a portion of the sensing tube.

09/603,935

KICHP0102USA

38. (Original) The pressure transducer of claim 36, wherein the sensor includes at least one strain gage mounted on the sensing tube for measuring deformation of the at least a portion of the sensing tube.

39. (Withdrawn) The pressure transducer of claim 36, wherein the sensor includes at least one piezoelectric device for measuring deformation of the at least a portion of the sensing tube.

40. (Withdrawn) The pressure transducer of claim 36, wherein the sensor includes a light source and a light detector for measuring deflection of the at least a portion of the sensing tube.

41. (Withdrawn) The pressure transducer of claim 36, wherein the sensor includes a capacitance probe for measuring deflection of the at least a portion of the sensing tube.

42. (Withdrawn) The pressure transducer of claim 36, wherein the sensor includes a continuum wave source and a continuum wave detector for measuring deflection of the at least a portion of the sensing tube.

43. (Original) The pressure transducer of claim 36, wherein the sensing tube is made of a generally rigid material.

44. (Original) The pressure transducer of claim 43, wherein the generally rigid material is a metal.

45. (Currently Amended) The pressure transducer of claim 36, wherein the ~~further comprising a housing~~ surrounds ~~surrounding~~ the sensing tube and the sensor.

09/603,935

KICHP0102USA

46. (Withdrawn) The pressure transducer of claim 36, wherein the sensing tube includes a flow restriction therein.

47. (Currently Amended) A method of measuring fluid pressure, comprising:
at least partially enclosing in a housing a sensing tube which includes a flow passage therethrough; and
measuring strain in the sensing tube ~~a flow passage~~ due to fluid flowing through the flow passage ~~therewithin~~, as a representation of the fluid pressure.

48. (Currently Amended) The method of claim 47, wherein the measuring strain includes measuring strain with one or more strain gages placed on an outer surface of the sensing tube ~~flow passage~~.

49. (Original) The method of claim 47, further comprising placing the strain gages in a bridge configuration to increase an output signal.

50. (Currently Amended) The method of claim 47, wherein ~~the flow passage is a sensing tube, and further comprising enclosing the sensing tube and the strain gages~~ are fully enclosed in a housing.

51. (Withdrawn) The method of claim 50, further comprising structurally isolating at least a portion of the sensing tube from the housing.

52. (Original) The method of claim 50, further comprising placing the strain gages on portions of the sensing tube which have a maximum strain response.

53. (Original) The method of claim 47, wherein the measuring strain includes measuring both axial and circumferential strains.

09/603,935KICHP0102USA

54-73. (Canceled)

74. (New) A pressure transducer comprising:

a sensing tube allowing flow therethrough, at least a portion of which mechanically deforms in response to a pressure on one side thereof; and

at least four strain gages on the sensing tube for measuring deformation of the at least a portion of the sensing tube; and

wherein at least two of the strain gages are configured for measuring axial strain and another at least two of the gages are configured for measuring circumferential strain; and

wherein the at least two of the gages used for measuring axial strain and the another at least two of the gages used for measuring circumferential strain are connected together in a Wheatstone bridge.

75. (New) The pressure transducer of claim 74, further comprising a housing at least partially surrounding the sensing tube.

76. (New) The pressure transducer of claim 75, wherein the housing encircles the sensing tube.

77. (New) The pressure transducer of claim 76, wherein the sensing tube is attached to the housing.

78. (New) The pressure transducer of claim 77, wherein the sensing tube includes an end portion which is attached to the housing and a central portion to which the at least one strain gage is mounted.

79. (New) The pressure transducer of claim 78, wherein the end portion has a thicker wall than the central portion.

09/603,935KICHP0102USA

80. (New) The pressure transducer of claim 79, wherein the sensing tube further includes a curved portion linking the end portion and the central portion.

81. (New) The pressure transducer of claim 80, wherein the curved portion has a constant radius of curvature.

82. (New) The pressure transducer of claim 80, wherein at least one of the at least one strain gage is located adjacent to the curved portion.

83. (New) A pressure transducer comprising:
a sensing tube allowing flow therethrough, at least a portion of which changes shape in response to a pressure on one side thereof; and
a sensor for measuring the changes in shape of the at least a portion of the sensing tube;
wherein the sensor includes:
at least two of the strain gages configured for measuring axial strain of the at least a portion of the axial tube; and
another at least two of the gages configured for measuring circumferential strain of the at least a portion of the axial tube; and
wherein the at least two of the gages used for measuring axial strain and the another at least two of the gages used for measuring circumferential strain are connected together in a Wheatstone bridge.

84. (New) The pressure transducer of claim 83, further comprising a housing at least partially surrounding the sensing tube.

85. (New) The pressure transducer of claim 84, wherein the housing encircles the sensing tube.

09/603,935

KICHP0102USA

86. (New) The pressure transducer of claim 85, wherein the sensing tube is attached to the housing.

87. (New) The pressure transducer of claim 86, wherein the sensing tube includes an end portion which is attached to the housing and a central portion to which the at least one strain gage is mounted.

88. (New) The pressure transducer of claim 87, wherein the end portion has a thicker wall than the central portion.

89. (New) The pressure transducer of claim 88, wherein the sensing tube further includes a curved portion linking the end portion and the central portion.

90. (New) The pressure transducer of claim 89, wherein the curved portion has a constant radius of curvature.

91. (New) The pressure transducer of claim 89, wherein at least one of the at least one strain gage is located adjacent to the curved portion.

92. (New) A method of measuring fluid pressure, comprising:
measuring strain in a sensing tube at least partially enclosing a flow passage, due to fluid flowing within the flow passage, as a representation of the fluid pressure;
wherein the measuring strain includes measuring strain with four or more strain gages placed on an outer surface of the sensing tube; and
wherein the strain gages are coupled together in a bridge configuration.

93. (New) The method of claim 92, wherein the measuring strain includes measuring axial strain of the sensing tube with at least two of the strain gages, and

09/603,935

KICHP0102USA

measuring circumferential strain of the sensing tube with another at least two of the strain gages.

94. (New) The method of claim 92, wherein the sensing tube and the strain gages are fully enclosed in a housing.

95. (New) The pressure transducer of claim 1 in combination with a pair of pipe segments to which the housing is mechanically coupled;

wherein the housing transmits external loads between the pipe segments, thereby preventing the external loads from being transmitted to the sensing tube.

96. (New) The pressure transducer of claim 95, wherein the sensing tube includes an end portion which is attached to the housing and a central portion to which the at least one strain gage is mounted; and wherein the end portion has a thicker wall than the central portion.

97. (New) The pressure transducer of claim 22, wherein the at least one strain gage includes:

first strain gages for measuring axial strains; and

second strain gages for measuring circumferential strains; and

wherein the first strain gages are located adjacent to the curved portion of the sensing tube.

98. (New) The pressure transducer of claim 97, wherein the second strain gages are located on the sensing tube closer than the first strain gages to a middle of the sensing tube.

99. (New) The pressure transducer of claim 97, wherein the first strain gages and the second strain gages are coupled together in a Wheatstone bridge.